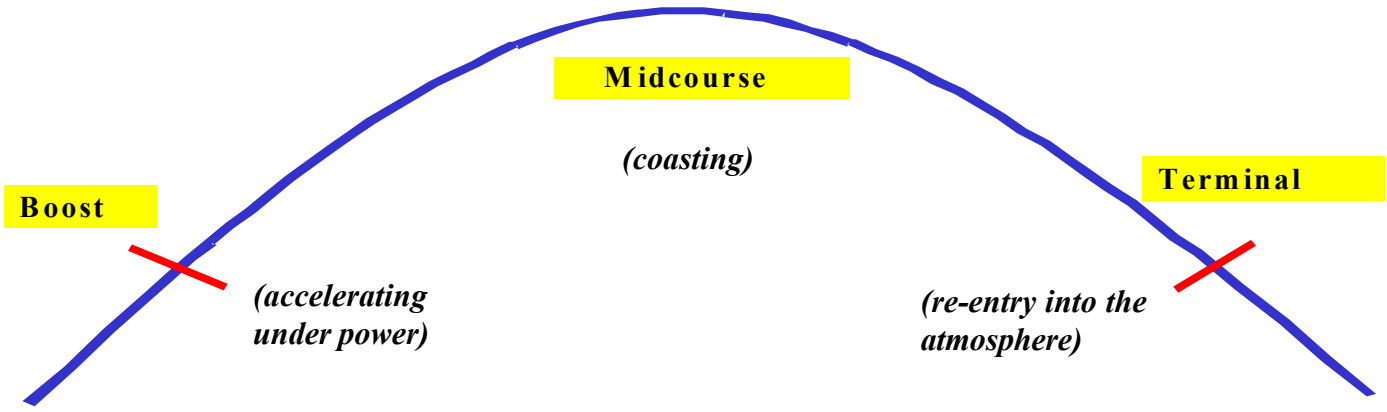
MISSILE DEFENSE AGENCY
MDA In-depth
Making Ballistic Missile Defense A Reality...

Ballistic Missile Defense Challenge

The Threat Is Real And Growing

While the end of the Cold War signaled a reduction in the likelihood of global conflict, the threat from foreign missiles has grown steadily as sophisticated missile technology becomes available on a wider scale. The proliferation of weapons of mass destruction and the ballistic and cruise missiles that could deliver them pose a direct and immediate threat to the security of U.S. military forces and assets in overseas theaters of operation, our allies and friends, as well as our own country. At least 25 countries now possess —or are acquiring— nuclear, biological and chemical (NBC) weapons. Since 1980, ballistic missiles have been used in six regional conflicts. During the Gulf War, 28 U.S. service personnel died from an Iraqi Scud missile attack.

Ballistic Missile Characteristics



All ballistic missiles share a common, fundamental element. They follow a ballistic trajectory that includes three phases: boost phase, midcourse phase, and terminal phase. The boost phase is the portion of a missile's flight when it is thrusting to gain the velocity needed to reach its target. This phase usually lasts between one and five minutes depending on the range of the missile. During this phase the rocket is climbing against the earth's gravity and either exiting the earth's atmosphere into outer space, or in the case of shorter range missiles, only reaching the fringes of outer space.

Once the missile has completed firing its propulsion system, it begins the longest part of its flight, known as the midcourse phase. During this phase the missile is coasting, or freefalling towards its target. This phase can last as long as 20 minutes in the case of intercontinental ballistic missiles (ICBMs). Most missiles that leave the atmosphere shed their rocket motors by this time in order to increase the range that the missile's weapon, know as a warhead, can travel. For medium- and long-range missiles this phase occurs outside the earth's atmosphere, or in the exo-atmosphere.

The final phase of a missile's flight is the terminal phase. During this phase the missile's warhead re-enters the earth's atmosphere at speeds over 2,000 mph. This phase lasts less than a minute for ICBM-class missiles.

Boost Phase – "Early Intercepts are Best"

Intercepting a missile in its boost phase is the ideal solution for a ballistic missile defense. If the missile is carrying a chemical, biological, or nuclear weapon the debris will most likely fall on the country that launched the missile. At the least, it will certainly not have obtained enough velocity to reach its intended target. Because of this, it is not critical to completely destroy the missile's warhead.

Although attacking a missile while it is struggling against the earth's gravity is ideal, it poses significant challenges to a defender. First, the boost phase is relatively short. This means that sensors will have to detect a launch and relay accurate information about the missile very quickly. Second, an interceptor missile would have to be very close, or extremely fast to catch up to the accelerating missile.

When possible, for the global coverage and protection against more lethal payloads it can provide, a capability to intercept a missile near its launch point is always preferable to attempting to intercept that same missile closer to its target.

Midcourse Phase – "Largest Intercept Window"

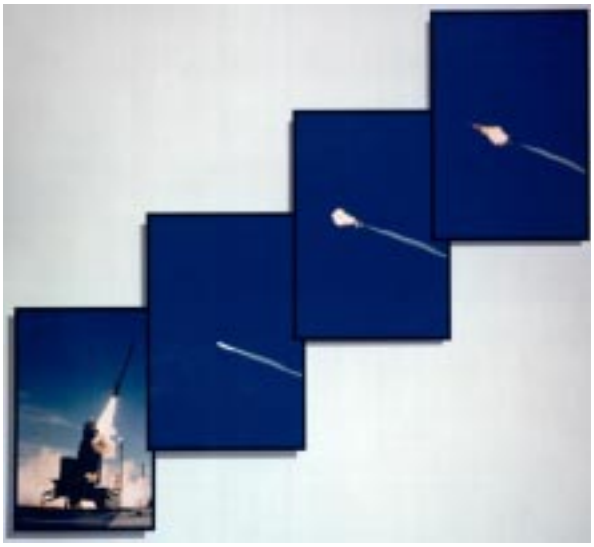
The midcourse phase allows the largest opportunity to intercept an incoming missile. At this point the missile has stopped thrusting so it follows a more predictable path. Depending on the interceptor launch location, multiple interceptors could be launched, with a delay between them to see if the first ones were successful. Since the interceptor has a longer time to engage, fewer interceptor sites are needed to defend larger areas.

Unfortunately, a longer period in space provides an attacking missile the opportunity to deploy countermeasures against a defensive system. However the defensive system also has more time to observe and discriminate countermeasures from the warhead.

Terminal Phase – "The Catcher's Mitt"

The terminal phase of ballistic missile's flight is normally less than one minute long. At this point, defensive systems must be very close to the missile's target in order to defend against the attack. In a sense, it is like a catcher behind the plate in a baseball game. As long as the pitch is near the plate, the catcher can catch the throw.

Countermeasures are less of a challenge in this phase. They usually fall slower than the warhead and are burned up as the warhead re-enters the atmosphere. Defensive systems designed for the terminal phase are most effective in protecting troop concentrations, ports, airfields, and staging areas.



Meeting the Challenge

The U.S. currently has no defense to protect Americans against ballistic missile attack. President George W. Bush stated: "America's development of a missile defense is a search for security, not a search for advantage."

There are merits and challenges to intercepting a threat missile in each of the phases discussed in this paper. The capability to defend against an attacking missile in all of the phases is called a layered defense, and it increases the chances that the missile and its payload will be destroyed. By attacking the missile in all phases of flight, we can exploit opportunities to increase the advantage of the defensive system. A capability to intercept a missile in the boost phase could destroy a missile regardless of its range or intended aim-point and provide a global coverage capability. A midcourse intercept capability could provide wide coverage of a region or regions, while a terminal defense could protect a localized area.

When we combine intercept opportunities in all phases of flight, we significantly increase the probability of success. Improving the odds of interception is critical when the attacking missiles carry weapons of mass destruction.

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http://www.acq.osd.mil/bmdo/bmdolink/html/

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